EXHIBIT A

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Lightsey

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(54) **HEATING BLANKET HAVING AN EMBEDDED CONTROL SWITCH AND AN EXTERNAL CONTROL MODULE**

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CPC ***H05B 1/0272*** (2013.01); ***H05B 3/342*** (2013.01)

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CPC H05B 1/0272; H05B 3/342; H05B 3/34; H05B 3/56; H05B 2203/029
USPC 219/494, 501, 505, 497, 506
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

7,566,846	B1 *	7/2009	Sorensen	H05B 1/02 2/905
2003/0047556	A1 *	3/2003	Horey	H05B 3/342 219/497
2003/0052120	A1 *	3/2003	Zabrowsky	H05B 1/0272 219/501
2013/0134149	A1 *	5/2013	Weiss	H05B 3/146 219/481
2013/0172964	A1 *	7/2013	Mills	A61F 7/0097 607/96
2019/0059544	A1 *	2/2019	Rhett, Jr.	A45C 15/00

* cited by examiner

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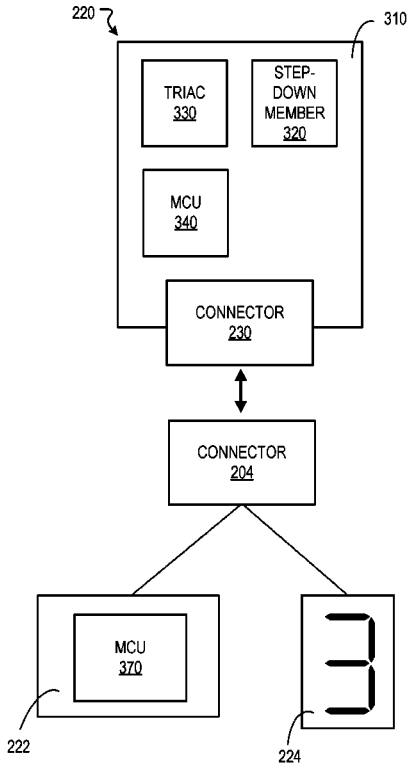
(57) **ABSTRACT**

A heating blanket system comprises a blanket, one or more heating wires embedded within the blanket, a control switch embedded in the blanket, the control switch being configured to allow a user to adjust a temperature setting of the blanket, and an external control module detachably connectable to the control switch and the one or more heating wires, the external control module configured to receive the temperature setting from the control switch and configured to control current flow through the one or more heating wires based on the temperature setting, the external control module being external to the blanket.

17 Claims, 4 Drawing Sheets



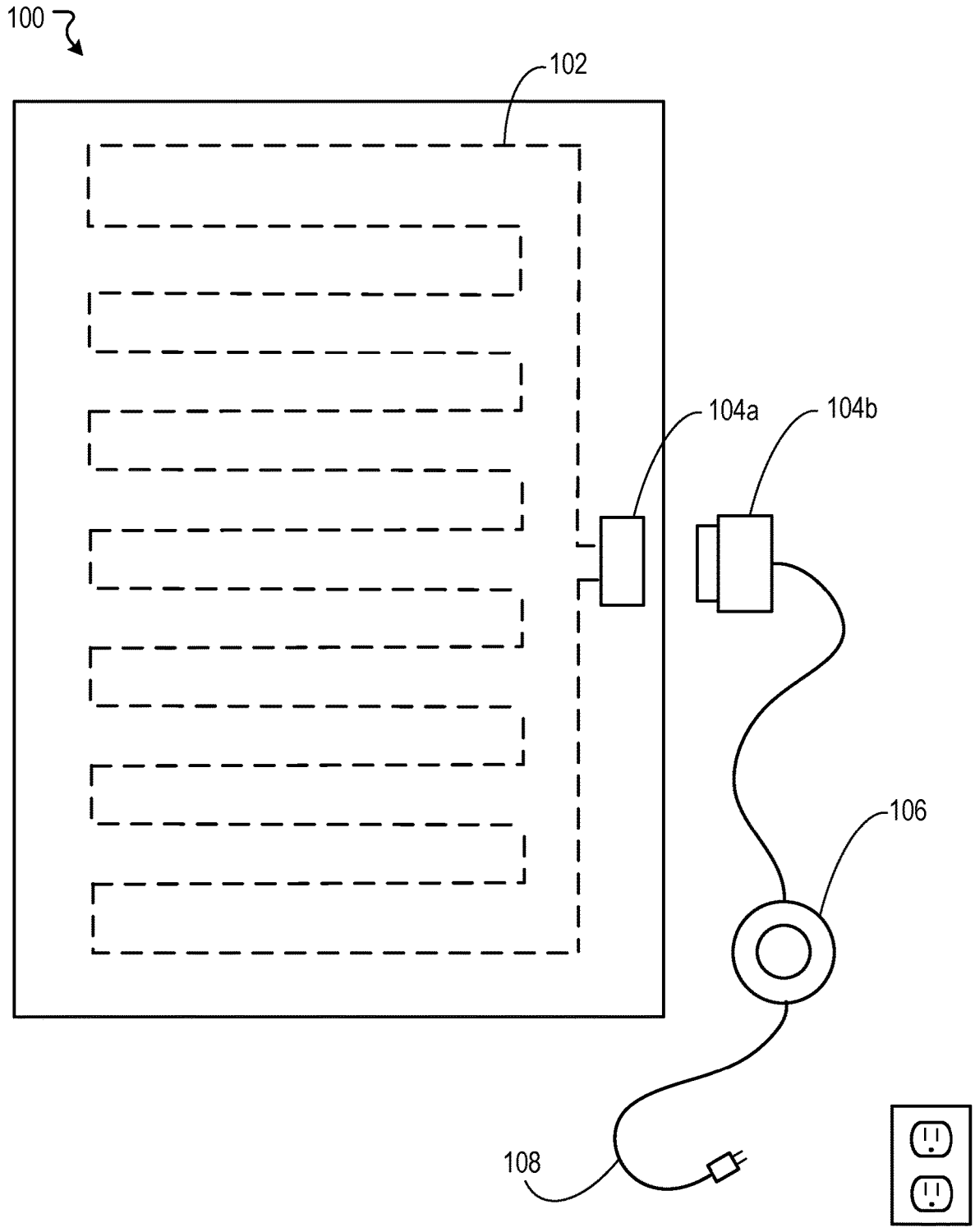


FIGURE 1
(PRIOR ART)

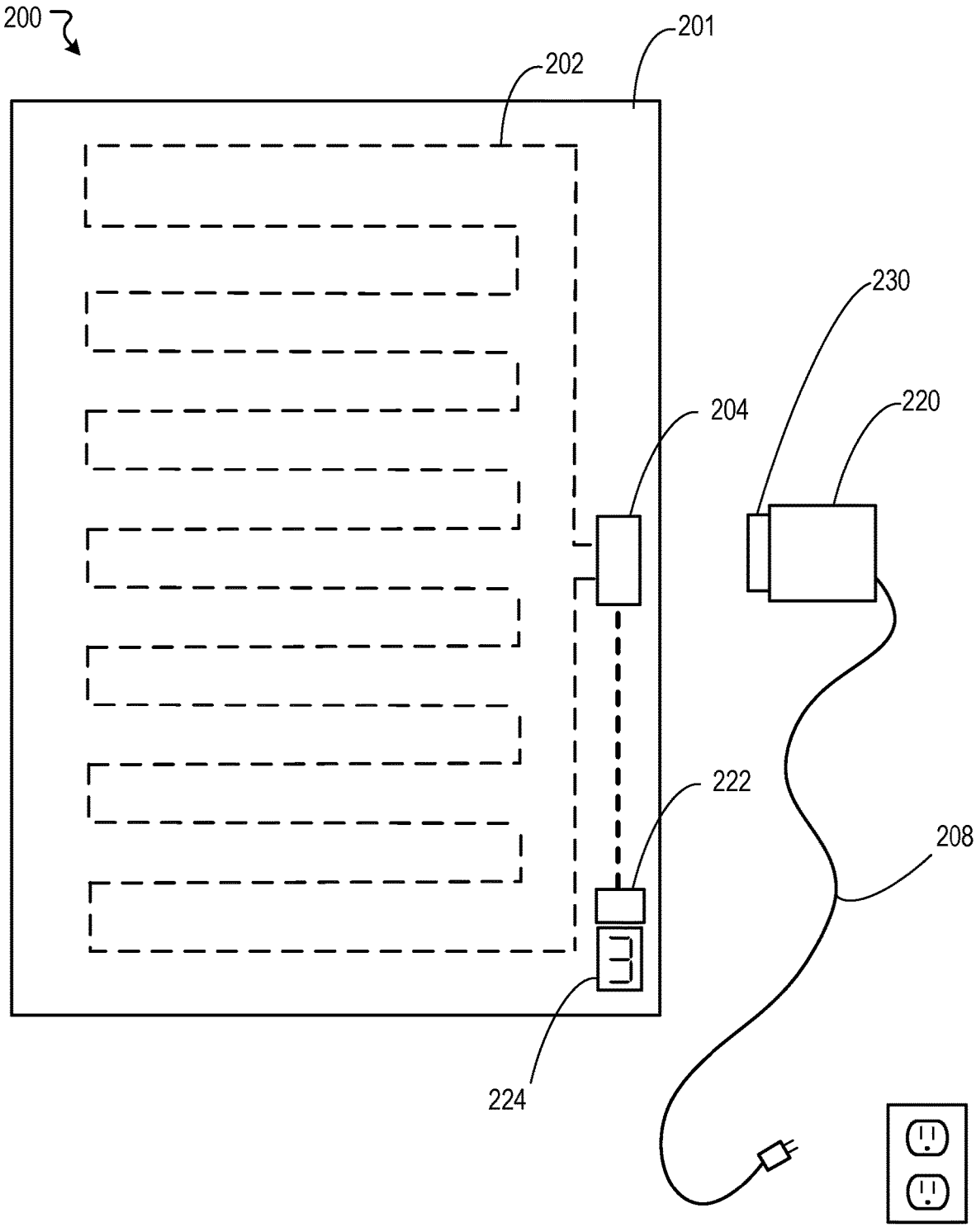


FIGURE 2

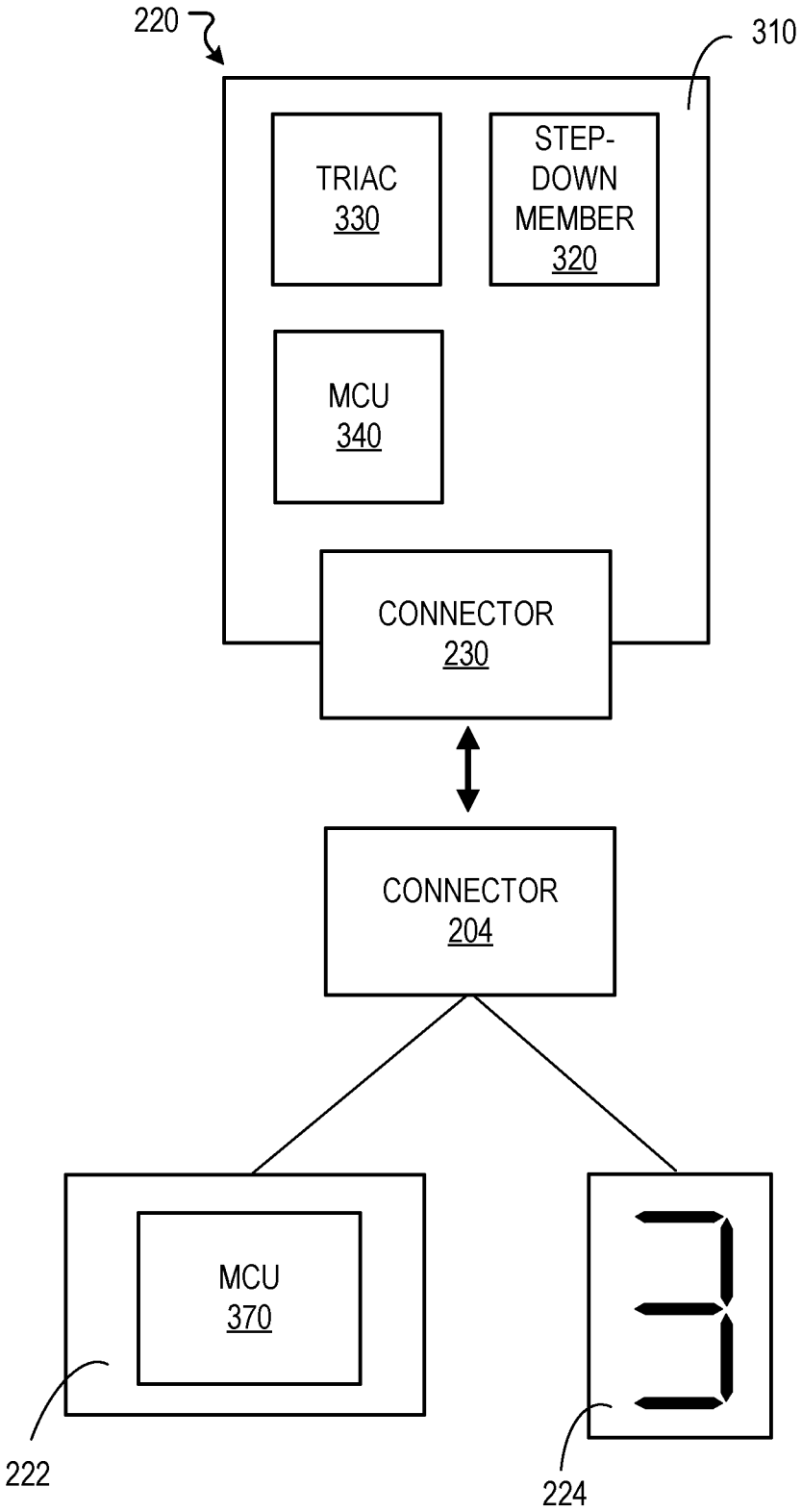

220
310
TRIAC
330
STEP-
DOWN
MEMBER
320
MCU
340
CONNECTOR
230
CONNECTOR
204
MCU
370
222
224

FIGURE 3

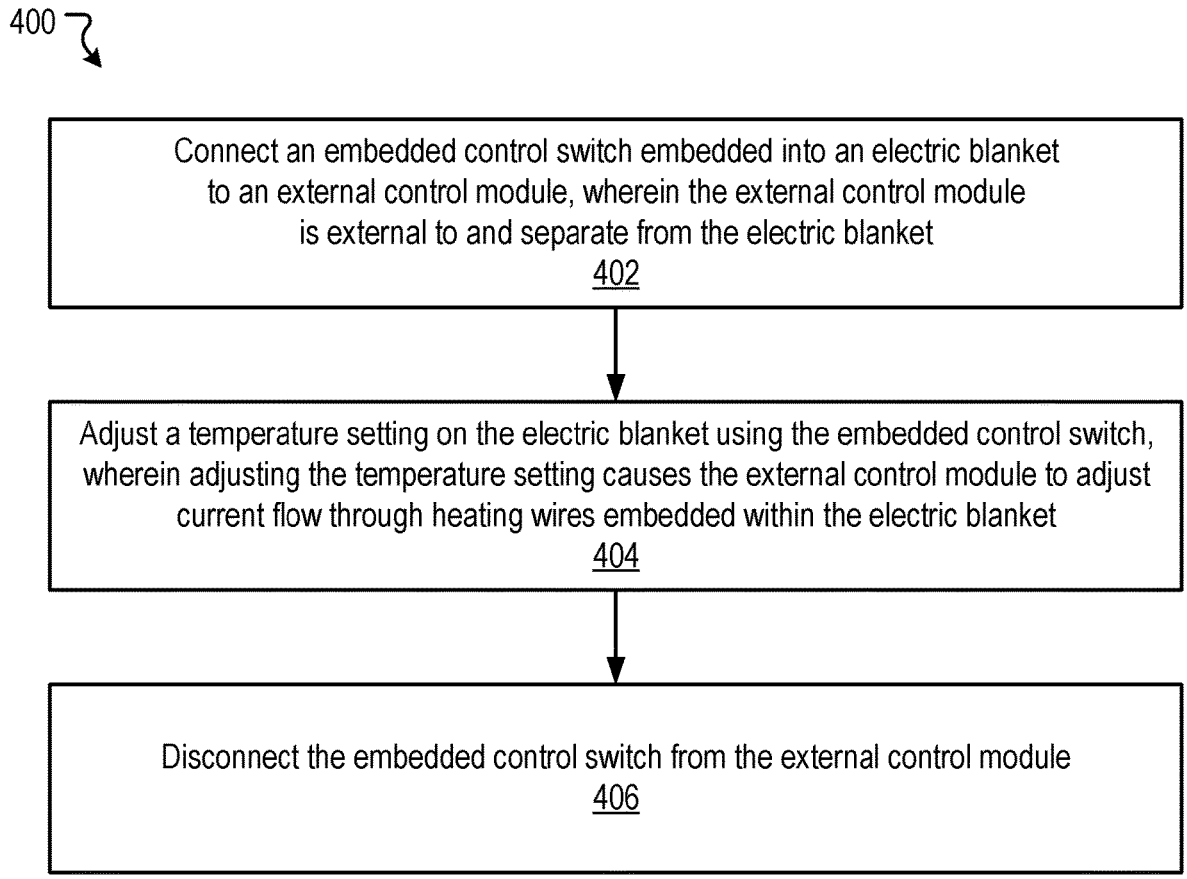

400
Connect an embedded control switch embedded into an electric blanket to an external control module, wherein the external control module is external to and separate from the electric blanket
402
Adjust a temperature setting on the electric blanket using the embedded control switch, wherein adjusting the temperature setting causes the external control module to adjust current flow through heating wires embedded within the electric blanket
404
Disconnect the embedded control switch from the external control module
406

FIGURE 4

HEATING BLANKET HAVING AN EMBEDDED CONTROL SWITCH AND AN EXTERNAL CONTROL MODULE

TECHNICAL FIELD

The present technology relates to electric heating blankets. More particularly, the present technology relates to heating blankets having an embedded control switch and an external control module.

BACKGROUND

Conventional electric heating blankets typically include heating wires within the blanket. The heating wires may be connected to an electric power source. When the blanket is being powered by the power source, current passes through the resistive heating wires, thereby causing the heating wires to generate heat to heat the blanket. A control switch positioned between the heating wires and the power source can be used to control the amount of current that passes, thus controlling the amount of heat generated by the heating wires and controlling the temperature of the blanket.

FIG. **1** depicts an example conventional electric heating blanket **100**. The conventional blanket **100** includes a resistance wire **102** embedded within the blanket. The resistance wire **102** is connected to a first connector **104***a*. The first connector **104***a* is configured to connect to a complementary second connector **104***b*. The complementary second connector **104***b* is connected to a power cable **108** and a control switch **106**. The second connector **104***b*, the control switch **106**, and the power cable **108** are external to the blanket **100**. Connecting the first connector **104***a* to the complementary second connector **104***b* connects the resistance wire **102** to the control switch **106** and the power cable **108**. As shown in FIG. **1**, the control switch **106** includes a dial that a user can rotate to increase or decrease the temperature setting of the heating blanket **100**. The control switch **106** can be placed on the floor, on the bed, or on top of or next to a user while the user is using the heating blanket **100**. The separate, external control switch **106** can be cumbersome and inconvenient for a user.

SUMMARY

Embodiments of the invention may provide a heating blanket system, comprising a blanket, one or more heating wires embedded within the blanket, a control switch embedded in the blanket, the control switch being configured to allow a user to adjust a temperature setting of the blanket, and an external control module detachably connectable to the control switch and the one or more heating wires, the external control module configured to receive the temperature setting from the control switch and configured to control current flow through the one or more heating wires based on the temperature setting, the external control module being external to the blanket.

The external control module may comprise a circuit board including circuitry for controlling current flow through the one or more heating wires based on a temperature setting of the blanket. The external control module may include a triode for alternating current (TRIAC) for generating current flow for the one or more heating wires. The control switch may be waterproof, and the external control module may not be waterproof. The heating blanket system may further comprise a display embedded into the blanket. The display may be configured to display a temperature indicator based on a temperature setting of the blanket, the temperature indicator including a temperature color based on the temperature setting. The external control module may comprise an external control module microcontroller (MCU). The control switch may comprise a control switch MCU configured to communicate with the external control module MCU. The external control module MCU may be configured to control the display. The control switch MCU may be configured to control the display. The external control module MCU may be configured to communicate error messages to the control switch MCU for presentation on the display.

Embodiments of the present invention may provide a method comprising receiving a temperature setting from a user of a heating blanket by a control switch embedded in the heating blanket, delivering by the control switch a temperature signal based on the temperature setting to an external control module, the external control module being external to the heating blanket and detachably couplable to the control switch, receiving by the external control module the temperature signal from the control switch, and adjusting by the external control module current flow through one or more heating wires embedded in the heating blanket, the current flow being based on the temperature signal.

The external control module may include a TRIAC for generating current flow for the one or more heating wires. The control switch may be waterproof, and the external control module may not be waterproof. A display embedded in the heating blanket will present a temperature indicator based on the temperature setting, the temperature indicator including a temperature color based on the temperature setting. The external control module may include an external control module microcontroller (MCU). The control switch may include a control switch MCU configured to communicate with the external control module MCU. In some embodiments, the external control module MCU may be configured to control the display. In some embodiments, the control switch MCU may be configured to control the display.

Many other features, applications, embodiments, and/or variations of the disclosed technology will be apparent from the accompanying drawings and from the following detailed description. Additional and/or alternative implementations of the structures, systems, and methods described herein can be employed without departing from the principles of the disclosed technology.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** illustrates a conventional electric blanket.

FIG. **2** illustrates a heating blanket, according to an embodiment of the present disclosure.

FIG. **3** illustrates a block diagram of various components of the external control module and control switch of the heating blanket, according to an embodiment of the present disclosure.

FIG. **4** illustrates an example method, according to an embodiment of the present disclosure.

The embodiments shown in the figures are for purposes of illustration only. Like reference numerals identify like elements. Alternative embodiments of the structures and methods illustrated and described herein can be employed without departing from the principles of the disclosed technology.

DETAILED DESCRIPTION

As stated above, conventional electric heating blankets typically include heating wires located within the blanket.

The heating wires are connected to an electric power source (e.g., a power cable connected to a power outlet). When the power cable is connected to the electric power source, the power source causes current to flow through the resistive heating wires, thereby causing the heating wires to generate heat to heat the blanket. A control switch positioned between the heating wires and the power source can be used to control the amount of current that flows through the heating wires, and thus to control the amount of heat generated by the heating wires and the temperature of the blanket.

FIG. **2** illustrates a blanket system **200**, according to an embodiment of the present disclosure. The blanket system **200** includes a blanket **201**, one or more heating wires **202** embedded within the blanket **201**, an embedded control switch **222**, and a connector **204**. In some embodiments, the blanket **201** may include a throw, a quilt, a duvet, a comforter, a mattress pad, a bed sheet, or the like. In some embodiments, the one or more heating wires **202** may be embedded within the material (e.g., fabric) of the blanket **201**. In some embodiments, the embedded control switch **222** is substantially embedded in and secured to the blanket **201**. In some embodiments, the connector **204** has at least a portion embedded within the blanket **201** and a portion that extends outside to the blanket **201** so that the connector **204** can be connected to an external control module **220**. In some embodiments, the connector **204** is entirely outside the blanket **201**.

The embedded control switch **222** can include, for example, one or more buttons, knobs, switches, and the like, that a user can operate to increase or decrease the temperature setting of the blanket **201**. In some embodiments, the embedded control switch **222** is made of soft, flexible material, e.g., rubber, for user comfort.

In some embodiments, the blanket system **200** also includes a display **224** to present a temperature indicator based on the selected temperature setting. The display **224** may be implemented using one or more of a seven segment display, a liquid crystal display, LEDs, and the like. In some embodiments, the display **224** may include multiple colored LEDs to change the color of the display **224** based on the temperature setting of the blanket system **200**. In some embodiments, the display **224** may be lighted blue when set to a low temperature, green when set to a low medium temperature, orange when set to a high medium temperature, and red when set to a high temperature. Like the embedded control switch **222**, the display **224** may also be substantially permanently embedded into and secured to the blanket **201**. In other embodiments, the display **224** may be separate from and/or separable from the blanket **201**.

The heating wire **202** and the embedded control switch **222** are coupled to the connector **204**, which is configured to connect to a complementary external connector **230**. The complementary external connector **230** may be integrated into or separate from the external control module **220**. The external control module **220** may be connected to a power cable **208**, which may be connected to receive power from a power source. Connecting the connector **204** to the complementary external connector **230** connects the heating wire **202** and the embedded control switch **222** to the external control module **220** and the power cable **208**. In some embodiments, the external control module **220** may include a battery pack (not shown) to power the heating blanket system **200** in addition to or instead of the power cable **208**. The external control module **220** can include circuitry to control the temperature of the blanket **201** based on the temperature setting of the embedded control switch **222**. In some embodiments, the display **224** may be coupled to and controlled by the embedded control switch **222**. In some embodiments, the display **224** may be coupled to the connector **204** and controlled by the external control module **220**.

In some embodiments, the external control module **220** sends input current to the embedded control switch **222**, which receives the input current and generates output current (e.g., none if off) based on the temperature setting (on, off, temperature level). The output current may be transmitted back to the external control module **220**, which uses the output current to generate control current to control the one or more heating wires **202**.

In some embodiments, the external control module **220** may send input current to the embedded control switch **222**, which receives the input current and uses an internal microcontroller unit (MCU) to generate an output signal based on the temperatures setting (on, off, and/or temperature level), The output signal may be transmitted back to the external control module **220**, which uses the output signal to generate the control current to control the one or more heating wires **202**.

In some embodiments, the embedded control switch **222** includes an internal power source, such as a removable/replaceable battery, to power an internal microcontroller unit (MCU). In some embodiments, the battery compartment may be waterproofed. The internal MCU in the embedded control with may be in Bluetooth®, radio frequency and/or other wireless communication with the external control module **220**. In some embodiments, the embedded control switch **222** need not be powered by or wire connected to the external control module **220**. The internal MCU may transmit wirelessly a temperature signal based on the temperature setting to the external control module **220**, which uses the temperature signal to control the current flow through the one or more heating wires **202**.

In some embodiments, the embedded control switch **222** is coupled to the display **224**, and based on the temperature setting of the embedded control switch **222** controls the display **224** to present the temperature setting as a number, a color, or a level indicator. In some embodiments, the display **224** is coupled to the connector **204**. The external control module **220** receives the temperature setting from the embedded control switch **222**, and sends a control signal to control the display **224** to present the temperature setting.

Other alternatives are possible.

It will be appreciated that the blanket system **200** may include multiple zones, e.g., a left zone having a first heating wire controlled by a first embedded control switch and a right zone having a second heating wire controlled by the second embedded control switch. This design may be preferred on a queen or king sized blanket system **200**, so that each of two partners can control their respective sides of the blanket system **200**.

It will be appreciated that, in some embodiments, the blanket system **200** includes a wireless application program interface (API) to enable a user to control the temperature setting of the blanket system **200**. In some embodiments, the wireless API may be located in the embedded control switch **222** in addition to or instead of the buttons, knobs and/or switches. In some embodiments, the wireless API may be in the external control module **220**, which communicates received temperatures setting information from the user to the embedded control switch **222**. In some embodiments, the external control module **220** controls the heating wire **202** based on the instruction received from the wireless API, without instruction from the embedded control switch **222**. In some embodiments, the external control module **220** may

instruct the display **224** to present the temperature setting. In some embodiments, the external control module **220** informs the embedded control switch **222** of the temperature setting, and the embedded control switch **222** may instruct the display **224** to present the temperature setting. In some embodiments, the external control module **220** receives the temperature setting request via the wireless API, transmits the request to the embedded control switch **222**, which processes the request and sends the instruction back to the external control module **220** as if it were received locally.

FIG. **3** illustrates an example embodiment of the external control module **220** coupled to the control switch **222** and the display **224**, according to an embodiment of the present disclosure. The external control module **220** includes a circuit board **310** that includes the connector **230** and a step-down member **320** that is electrically coupled to the connector **230** and configured to be controlled by the embedded control switch **222**. When the connector **230** is coupled to the connector **204**, the step-down member **320** can receive output current or output signals from a circuit board on the control switch **222**.

The circuit board **310** also includes a TRIAC **330** electrically coupled to the connector **230**. When the connector **230** is coupled to the connector **204**, the step down member **320** is configured to control the amount of current flowing through the heating wire **202**, thereby controlling the blanket temperature. Notably, by using a TRIAC **330**, the heating blanket **220** can avail itself of both sides of the AC current, thereby rendering the heating blanket more efficient.

In some embodiments, the circuit board **310** of the external control module **220** also includes a microcontroller (MCU) **340**. When the connector **230** is coupled to the connector **204**, the MCU **340** may be coupled to a circuit board on the embedded control switch **222**, to process the output signal received from the embedded control switch **222**. In some embodiments, the MCU **340** is also configure to send input signals to the embedded control switch **222**. Input signals may include error codes, control codes, etc.

When the connector **230** is coupled to the connector **204**, a user can operate the embedded control switch **222** to turn the heating blanket **201** on or off. The user can also operate the embedded control switch **222** to select a temperature setting of the blanket **201**. When the user turns on the blanket **201** using the embedded control switch **222**, the embedded control switch **222** transmits an output current or output signal to the MCU **340** to activate the TRIAC **330** and the step down member **320** based on the temperature setting, and thus to send a control current to the heating wire **202**. If the user operates the control switch **222** to turn off the blanket **201**, the embedded control switch **222** may stop sending output current or may send a corresponding turn-off signal to the MCU **340**. The MCU **340** may cause the TRIAC **330** or step down member **320** to shut-off current flow to the heating wire **202**.

In some embodiments, the embedded control switch **222** includes its own MCU **370**. The MCU **370** and the MCU **340** can be intercommunicate to control the blanket system **200**. In some embodiments, the embedded control switch **222** may not include its own MCU.

As discussed above, the display **224** can be configured to present the temperature setting or other information pertaining to the blanket system **200**. The display **224** may have its own MCU. The display **224** may be connected to the embedded control switch **222**, and the embedded control switch **222** (e.g., the MCU **370**) may control the display **224**. In some embodiments, the MCU **340** in the external control module **220** may control the display **224**. In some embodiments, the external control module **220** may use a two-way communication line between the external control module **220** and the embedded control switch **222** and/or the display **224** to send control information and/or messages (e.g., error messages) for presentation on the display **224**.

By embedding the embedded control switch **222** into the blanket **201**, a user is provided with convenient access to the embedded control switch **222** without having to a deal with a cumbersome external control switch. By making the embedded control switch **222** of soft, flexible material in some embodiments, it may be more comfortable for the user. By making the connector **204** and connector **230** detachably connectable in some embodiments, the blanket **201** can be detached from the external control module **220** and the power cable **208** for easy washing. In some embodiments, the embedded control switch **222** and the display **224** can be waterproofed for easy washing. By making the external control module **220** external to and separable from the blanket **201**, the blanket **201** can be washed without needing the external control module **220** to be waterproofed, which significantly reduces manufacturing costs of the blanket system **200**. By positioning the embedded control switch **222** remote from the external coupling, e.g., connector **204**, the embedded control switch **222** may be less sensitive to a reduced waterproofing design. Further, by not incorporating the sensitive circuits of the control module within the blanket **201**, e.g., at the position of the connector **204** or at the position of the embedded control switch **222**, the connector **204** is less sensitive to a reduced waterproofing design.

FIG. **4** illustrates an example method **400**, according to an embodiment of the present disclosure. There can be additional, fewer, or alternative steps performed in similar or alternative orders, or in parallel, within the scope of the various embodiments discussed herein unless otherwise stated.

Method **400** begins at block **402** with an embedded control switch **222** embedded into the blanket **201** being coupled to an external control module **220**, wherein the external control module **220** is external to and separate from the blanket **201**. At block **404**, a temperature setting on the embedded control switch **222** is controlled, thereby causing the external control module **220** to adjust current flow through the one or more heating wires **202** embedded within the blanket **201**. At block **406**, the embedded control switch **222** can be disconnected from the external control module **220**, e.g., for washing or storage.

It is contemplated that there can be many other uses, applications, and/or variations associated with the various embodiments of the present disclosure. Numerous specific details are set forth to provide a thorough understanding of the description. Embodiments of the disclosure can be practiced without these specific details. In some instances, modules, structures, processes, features, and devices are shown in block diagram form to avoid obscuring the description. In other instances, functional block diagrams and flow diagrams are shown to represent data and logic flows. The components of block diagrams and flow diagrams (e.g., modules, blocks, structures, devices, features, etc.) may be variously combined, separated, removed, reordered, and replaced in a manner other than as expressly described and depicted herein.

Reference in this specification to "one embodiment", "an embodiment", "other embodiments", "some embodiments", "various embodiments", or the like means that a particular feature, design, structure, or characteristic described in connection with the embodiment may be included in at least one

embodiment of the disclosure. The appearances of, for example, the phrase "in one embodiment" or "in an embodiment" in various places in the specification are not necessarily all referring to the same embodiment, nor are separate or alternative embodiments mutually exclusive of other embodiments.

The scope of the invention should not be limited by the detailed description, but rather by any claims that issue on an application based hereon. Accordingly, the embodiments described herein are intended to be illustrative and not limiting.

The invention claimed is:

1. A heating blanket system, comprising:

a blanket;

one or more heating wires embedded within the blanket;

a soft control switch embedded in the blanket at a first position on the blanket, the soft control switch being configured to allow a user to adjust a temperature setting of the blanket, the soft control switch being water secure for washing;

a display located at a second position on the blanket, the second position being proximate to the first position, the display being water secure for washing;

a connector located at a third position on the blanket, the third position being separated from the first position and the second position;

a power wire embedded in the blanket and electrically coupling the connector and the soft control switch, the power wire being different than the one or more heating wires; and

an external control module detachably connectable to the connector and to the one or more heating wires, the external control module configured to receive the temperature setting from the soft control switch and configured to control current flow through the one or more heating wires based on the temperature setting, the external control module being external to the blanket.

2. The heating blanket system of claim **1**, wherein the external control module comprises a circuit board including circuitry for adjusting the current flow through the one or more heating wires based on the temperature setting of the blanket.

3. The heating blanket system of claim **2**, wherein the external control module comprises a triode for alternating current (TRIAC) for generating the current flow for the one or more heating wires.

4. The heating blanket system of claim **1**, wherein the external control module is not waterproof.

5. The heating blanket system of claim **1**, wherein the display is configured to display a temperature indicator based on the temperature setting of the blanket, the temperature indicator including a temperature color associated with the temperature setting.

6. The heating blanket system of claim **1**, wherein the external control module comprises an external control module microcontroller unit (MCU).

7. The heating blanket system of claim **6**, wherein the soft control switch comprises a control switch MCU configured to communicate with the external control module MCU.

8. The heating blanket system of claim **7**, wherein the control switch MCU is further configured to control the display.

9. The heating blanket system of claim **8**, wherein the external control module MCU is configured to communicate error messages to the control switch MCU for presentation on the display.

10. A method comprising:

receiving a temperature setting by a soft control switch embedded in a heating blanket, the soft control switch being located at a first position on the blanket, the soft control switch being water secure for washing;

displaying a temperature indicator on a display located at a second position on the blanket, the second position being proximate to the first position;

receiving power by the soft control switch from an external control module via a power wire embedded in the blanket;

delivering by the soft control switch a temperature signal based on the temperature setting to the external control module, the external control module being external to the heating blanket and detachably connectable to the power wire via a connector, the connector being located at a third position on the blanket, the third position being separated from the first position and the second position;

receiving by the external control module the temperature signal from the soft control switch; and

adjusting by the external control module current flow through one or more heating wires embedded in the heating blanket, the current flow being based on the temperature signal, the one or more heating wires being different than the power wire.

11. The method of claim **10**, wherein the external control module comprises a triode for alternating current (TRIAC) for generating the current flow for the one or more heating wires.

12. The method of claim **10**, wherein the external control module is not waterproof.

13. The method of claim **10**, wherein the temperature indicator includes a temperature color based on the temperature setting.

14. The method of claim **13**, wherein the external control module comprises an external control module microcontroller unit (MCU).

15. The method of claim **14**, wherein the soft control switch comprises a control switch MCU configured to communicate with the external control module MCU.

16. The method of claim **15**, wherein the control switch MCU is further configured to control the display.

17. The method of claim **15**, wherein the external control module MCU is configured to control the display.

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